ARS-49-35
AUGUST 1959

UNITED STATES DEPARTMENT OF AGRICULTURE
Agricultural Research Service

REPORT ON EFFECTS OF CORN TOPPING[1/]

by

J. L. Schmidt and W. G. Lovely[2/]

Considerable interest has been shown in the last 2 or 3 years in corn topping prior to harvest and questions about its effects. Does corn topping hasten ear drying in the field or make for better picking through less stalk breakage and less material to handle in the picker? Does it reduce yield?

Grogan [3/] summarizes some results on detasseling effects and on the removal of a different number of leaves and the tassel from the plant. On certain occasions removal of the tassel before pollination has shown tremendous increases in yields. These increases occur when "unfavorable environmental conditions" such as drought, low soil fertility, or above-optimum plant populations exist. Removal of more than the tassel usually results in a reduction in yield. Kiesselback [4/] has reported a slight loss from removing the tassel only, a 3.5 percent loss when 1 leaf was removed with the tassel, a 5.9 percent loss from removing 2 leaves, and a loss of 13.6 percent when 3 leaves were removed with the tassel. Willard [5/] suggests expected yield reductions and very little increase in the rate of field drying from topping.

1/ Journal Paper No. J3699 of the Iowa Agricultural and Home Economics Experiment Station, Ames, Iowa. Project No. 1296.

2/ Analytical Statistician, Livestock Engineering & Farm Structures Research Branch; and Agricultural Engineer, Crop Production Engineering Research Branch, Agricultural Engineering Research Division, ARS, respectively.

3/ Grogan, C.A. Detasseling Responses in Corn. Agron. Jour. Vol. 48: 247-249. 1956.

4/ Kiesselback, T.A. The Detasseling Hazard of Hybrid Seed Corn Production. Agron. Jour. Vol. 37: 806-811. 1945.

5/ Willard, C. J. Does It Pay to Top Corn? What's New in Crops & Soils, 11(7): 15. 1959.

During 1958 agricultural engineers of the U. S. Department of Agriculture and the Iowa Agricultural Experiment Station ran corn topping experiments to study field ear drying and picker losses. The corn topping machine used in these experiments is shown in Figure 1.

Figure 1. Rotary corn topper mounted on high-clearance, self-propelled machine. This topper was used for both experiments.

FIELD DRYING EXPERIMENT

In this experiment the effects of corn topping on moisture content, yield, stalk breakage, shelling percentage, and the test weight of the shelled corn were studied.

Procedure

The topping machine was set to cut the stalk just above the tip of the highest ear in the row. This setting cut about 3 feet off the top

of the plant which is equivalent to taking the tassel and the first 4 or 5 leaves. The corn was topped (treated) at four different stages of growth. They were:

Treatment 1 - Ten days after pollination;

Treatment 2 - When the kernels contained 70 percent (wet basis) moisture (in roasting ear stage);

Treatment 3 - When the kernels contained 49 percent (wet basis) moisture (in dented stage);

Treatment 4 - When the kernels contained 37 percent (wet basis) moisture (in final maturing stage); and

Treatment 5 - Not topped, check.

The statistical design used in this experiment was a randomized block with 4 replicates. Each experimental plot consisted of 8 rows 150 feet long. The variety of corn used was Iowa 4570 planted in early May.

Throughout the season random samples consisting of 5 ears were taken from the two center rows in each experimental plot. This made a composite sample of 20 ears for each treatment per sampling date. The remaining rows were used for final yield tests and stalk breakage information.

Because the kernel moisture content reduces rapidly in the early stages of ear growth, it was necessary to take frequent samples at the beginning of the sampling period. Samples were taken 3 times weekly. This sampling rate continued while the ears were going through the roasting ear and dent stages of growth and until the kernels had reached approximately 40 percent moisture. Thereafter samples were taken less frequently.

The first sample was taken on August 13 - the kernel moisture content was 86 percent. The final sample was taken on November 14 - kernel moisture 15 percent.

Every sample taken during the season was processed to obtain a kernel moisture content, but frequently the ears in the sample were further processed (by complete shelling) in order to obtain information on cob moisture content, shelling percentage, and test weight of the kernels.

Results

Kernel moisture content

Figure 2 is a plot of the average kernel moisture contents of the composite 20-ear treatment samples taken on various dates. The solid line in Figure 2 connects the average moistures of the untopped corn. Statistically no significant differences were found between kernel moisture contents of topped and untopped corn in this season, 1958. The kernel moisture content of the topped corn reduced in the field at about the same rate as the untopped corn.

The variation in kernel moisture content of individual ears in a field is quite extensive; hence a rather large difference is required between the average moisture contents of two 20-ear samples before it is considered significant, i.e. due to treatment effect rather than sampling. Ordinarily an average difference of about 2.5 percent in kernel moisture content is required for significance and a difference of about 3.5 percent for high significance. In these data there were instances where even larger differences were required for significance.

Cob moisture content

Topping had no significant effect on cob moisture content. However, some interesting aspects were noticed regarding the cob moisture contents, which may be indicative of some effect of topping on cob moisture. For example, there were occurrences where the cobs of topped corn averaged slightly higher in moisture content than cobs of untopped corn. This was especially noticeable of cobs from corn topped 10 days after pollination. The moisture content of the cobs in corn topped 10 days after pollination was generally higher than the moisture content of cobs in untopped corn. This was true throughout the growing season and until the corn had matured to a point where the kernels had at least reached a moisture content below 26 percent. Thereafter the cob moisture contents in the topped corn was suddenly lower than in the untopped corn.

Another interesting aspect observed in these data was this: Almost invariably a corn sample taken shortly after a topping (from 3 days to as much as 12 days after in Treatment No. 1) showed cob moisture contents appreciably higher than in untopped corn. In subsequent samples, however, except in Treatment No. 1, the moisture contents of the cobs in topped corn again approached the moisture content of the cobs in untopped corn and eventually attained a moisture content lower than that of untopped corn.

The slightly higher cob moisture contents observed in the earlier topped corn and the higher than lower cob moistures observed in all topped

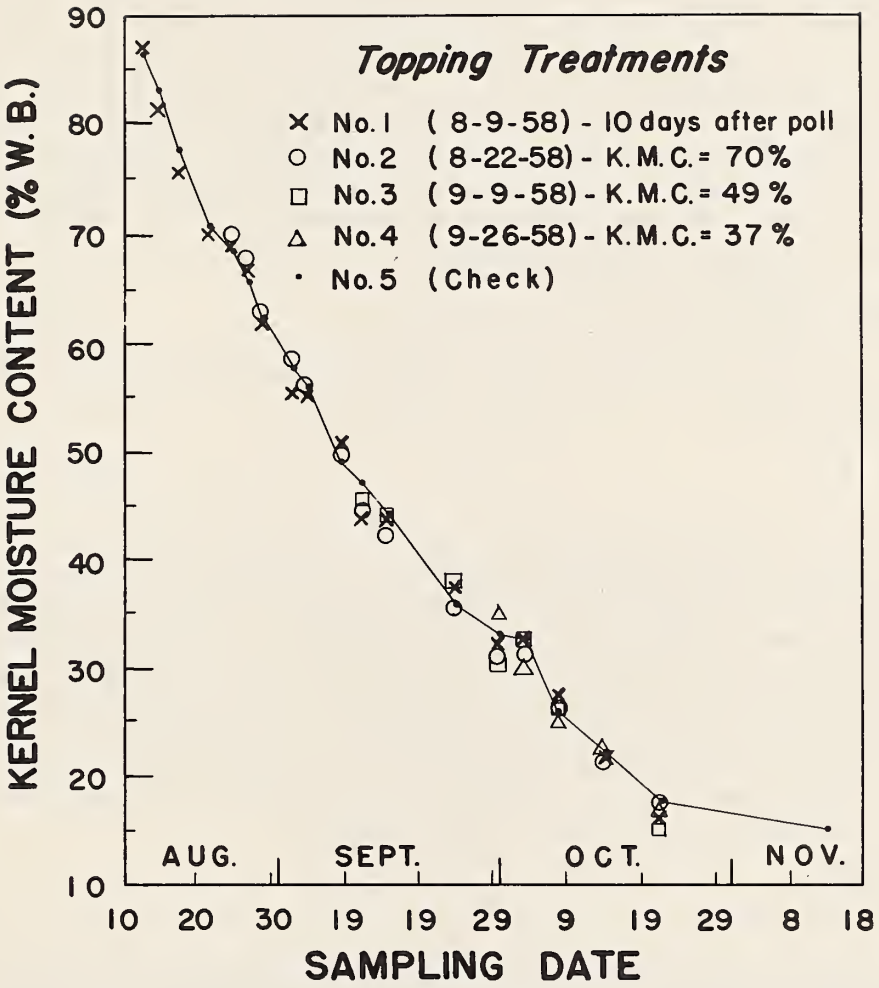

Figure 2 - Field kernel moisture contents of topped and untopped corn by sampling date.

corn compared to untopped corn may be indications that the plant tends to compensate for the missing portion of the plant cut off in the topping process. It may also indicate that perhaps some harm had been done in topping. Additional data are required, however, before the true relationship between cob moisture content and topping can be established.

Shelling percentage

Shelling percentage (the ratio of wet kernel weight to wet ear weight times 100) showed no significant difference between ears from topped and untopped corn in these data. There was, however, a tendency for lower shelling percentages to occur in topped corn. These slightly lower shelling percentages might be a reflection of the slightly higher cob moisture contents observed above.

Test weight (pounds per bushel)

Test weights of kernels from topped corn was about the same as from untopped corn.

Yields per acre

Some of the experimental plots in the topped corn had as high a yield as those in the untopped plots and a statistical analysis of the yield data showed no significant differences between the average yields of the topped and untopped corn in this season. Table 1 shows the average yields at the time of harvest for the different treatments. Though the differences between the treatment average yields were not great enough to be considered significant in the data, there was nevertheless a trend toward lower yields to be associated with time of topping. Whether this is an indication of an effect of topping can only be established from data of other seasons.

Stalk breakage

The average percentage of broken stalks for the different treatments is also shown in Table 1. In this study the percentage of broken stalks was about the same in the topped and untopped corn.

HARVESTING LOSSES AND LODGING EXPERIMENT

This experiment was conducted to determine the effect of topping on pre-harvest and harvest losses. Iowa C-92 seed corn was planted in early May.

Procedure

Topping was performed in the same manner as discussed in the first experiment. Corn was topped September 25 (35-percent-kernel moisture) and on October 3 (30-percent-kernel moisture). Half of the plots were harvested on October 20 and the other half on November 24. A two-row mounted picker, a two-row mounted picker sheller, and a two-row self-propelled combine were used for harvesting.

Table 1. Average yield and stalk breakage by treatment in corn topping study, Iowa State College, Ames, 1958.

Treatment (topping date)	Yield (Oct. 30)	Stalk breakage (Oct. 30)
1958	Bu. per acre	Percent
Aug. 9 (10 days after pollination)	99.8	10.5
Aug. 22 (kernel moisture 70 percent)	105.6	11.5
Sept. 9 (kernel moisture 49 percent)	107.7	10.8
Sept. 29 (kernel moisture 37 percent)	104.6	16.3
Check	112.4	11.6

Total stalks and lodged stalks were counted and dropped ears were picked up in each plot prior to harvesting. Following the picking operations the missed ears were picked up and the shelled corn on the ground was sampled.

Prior to the first harvest date, weather conditions were nearly ideal for field drying with very little wind to cause lodging. Between the first and second harvest dates (November 16) excessively high winds occurred that caused severe lodging of all unpicked corn.

RESULTS

Table 2 shows yields, stands, percent lodging, and harvesting losses that occurred in this experiment.

Yield differences were not large enough for significance at the 5-percent level between topped and untopped corn regardless of picker used.

The stand counts varied from 12,500 to 15,000 per acre, but as expected topping had no apparent effect on the number of stalks per acre.

Lodging as measured by the percent of stalks with ears touching the ground prior to picking was not materially affected by topping. This was true for both topping dates. Untopped corn had slightly fewer down stalks than the topped corn. At the second harvest date the percentage of down stalks had increased tremendously. This was due primarily to the excessively high winds that occurred on November 16. This strong wind caused approximately the same amount of lodging in corn topped September 25, in corn topped October 3, and in corn that was not topped.

Pre-harvest losses as measured by ears on the ground prior to picking were not significantly affected by either topping date. The high wind increased these losses, but these increases were approximately the same for topped and untopped corn.

The differences in corn losses due to topping as measured by missed ears were not large enough for significance at the 5-percent level. The September 25 topping had smaller losses than the October 3 topping with all three harvesters. The picker had larger losses than the picker-sheller or the combine. This was due to improper picker adjustment and not to topping. Losses from missed ears were much greater at the second harvest date because of the severe wind conditions.

Shelled corn losses at the snapping-rolls as indicated by the samples taken within the harvest rows showed no significant difference between topped and untopped corn for any of the three harvesters. Losses were greater at the second harvest date. There appeared to be smaller losses for the early harvest date with the picker and the combine when the corn was topped than when it was not topped. Additional work needs to be done before any definite statements can be made.

Shelled corn in the cobs and trash were collected for the combine and picker-sheller. These data showed less than 1 percent loss for topped or untopped corn harvested early or late with the picker-sheller or the combine. The differences among these small losses were not large enough for significance.

Table 2. The effect of topping on the yield, losses, and lodging of corn, 1958

Item	Topped Sept. 25		Topped Oct. 3		Untopped	
	Harvested:		Harvested:		Harvested:	
	Oct. 20	Nov. 24	Oct. 20	Nov. 24	Oct. 20	Nov. 24
Gross yield, bu. per acre	125	133	125	137	135	121
Stand, stalks per acre	13,600	13,500	13,800	14,300	15,000	12,500
Lodging, percent down stalks	13.9	81.9	14.3	80.5	10.7	70.1
Pre-harvest loss percent (bu. per acre)	5.4	12.9	6.2	14.6	5.2	14.8
Loss from missed ears, percent (bu. per acre)						
Picker	9.1	36.0	12.2	38.8	5.8	31.4
Combine	5.7	20.9	7.9	23.1	3.9	14.7
Picker-sheller	6.9	18.7	6.2	23.8	5.0	20.6
Average	7.2	25.2	8.8	28.6	4.9	22.2
Shelled corn loss at rolls, percent (bu. per acre)						
Picker	4.4	8.5	3.6	5.0	5.8	6.4
Combine	2.8	6.8	1.2	6.8	3.4	4.7
Picker-sheller	3.5	7.9	3.2	7.0	2.5	5.8
Average	3.6	7.7	2.6	6.3	3.9	5.6
Additional shelled corn loss, percent (bu. per acre)						
Picker	-	-	-	-	-	-
Combine	0.4	0.2	0.4	0.5	0.7	0.2
Picker-sheller	0.7	0.3	0.8	0.2	0.8	0.3
Average	0.6	0.2	0.6	0.4	0.8	0.2
Total harvesting loss, percent						
Picker	13.5	44.5	15.7	43.8	11.6	37.7
Combine	8.9	27.9	9.4	30.4	8.0	19.5
Picker-sheller	11.1	27.1	10.2	31.1	8.4	26.8
Average	11.2	33.2	11.8	35.1	9.3	28.0

Total harvesting losses were not materially affected by topping at either date. Topping did not reduce the losses for the picker, picker-sheller, or the combine. Larger losses occurred at the second harvest date.

SUMMARY

The results of these 1958 corn topping experiments did not show any significant effects from topping on the various corn factors studied. Kernel moisture contents, test weights, and stalk breakage percentages of topped corn were about the same as in untopped corn. Although not significant, the cob moisture contents in topped corn averaged slightly higher, and the shelling percentages and yields averaged slightly lower than in untopped corn.

Stands, lodging, pre-harvesting losses, or harvesting losses were approximately the same for different topping dates and between topped and untopped corn. The losses with the picker, picker-sheller, and the combine were not reduced by topping. Topping did not have any effect on losses for either early or late harvesting.

Results from a study of this type however are highly dependent upon weather conditions existing during the study. For example, the 1958 season with ample moisture and sunshine was an ideal season for an excellent corn crop. Weather conditions of this season may have reduced both the favorable and unfavorable effects expected of corn topping. Only with repeated studies over several years can the true effects of corn topping be established.